What is the NII?

- **A set of widely accessible and interoperable communications networks;**

- **Digital libraries, information databases and services;**

- **Easy to use information appliances and computer systems;**

- **Trained people who can build, operate and maintain these resources.**

- **All these integrated together to satisfy market demands**

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Sunrise: An Integrated Approach to NII

- **Build on HPCC strengths at LANL**
  - Develop HPCC as a commodity service
- **Use application suite to define infrastructure**
- **Design reusable components that span many disciplines:**
  - e.g., CFD simulation to telemedicine
  - data-mining is common to wide variety of problems
- **Use industrial standard, interoperable components wherever possible**
- **Build on network which provides high-bandwidth, multimedia for the future**
- **Live with existing bandwidth when necessary**

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The Problem of Integrating Applications

- *Application Integration* and *Distributed Processing* are the same thing:

- **Constructing information-sharing distributed systems from diverse sources:**
  - ❏ heterogeneous,
  - ❏ networked,
  - ❏ physically disparate,
  - ❏ multi-vendor.
  - ❏ disparate performance

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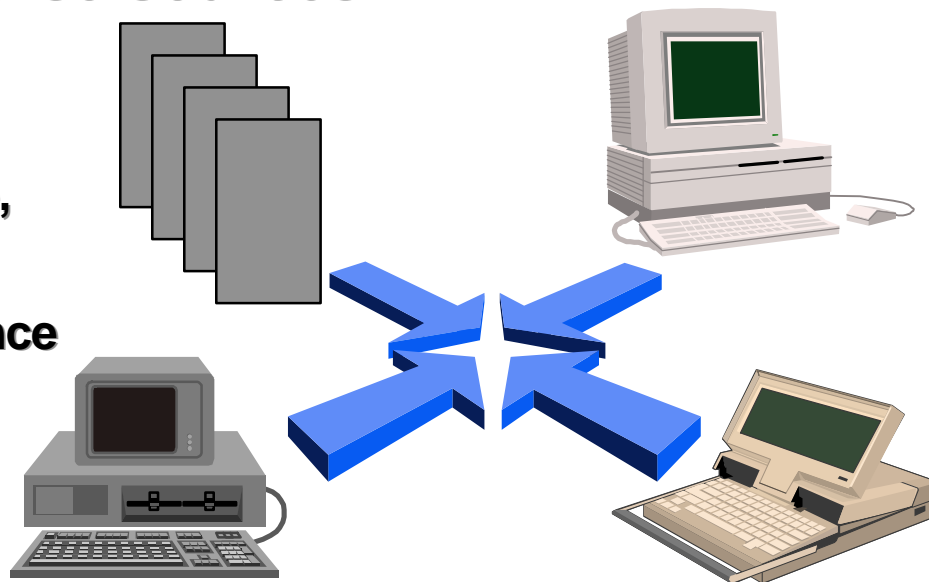
LANL Sunrise Project and Collaborations

LANL/ACL
Publish Global Ocean Model
Teleradiology analysis
Virtual collocation
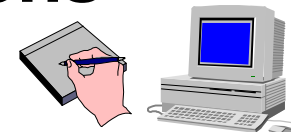**Data browsing**
Visualization

National Jewish Hospital Denver, CO
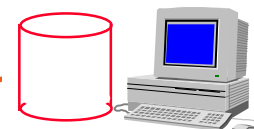Teleradiology
Clinical records

Xerox
Multilevel simulation
Virtual collocation
Organizational memory
Data browsing

ATM
Technet
Internet

Bank
Financial Data

LANL/Materials Lab
 Materials Database publishing
 Data browsing
 Virtual collocation

LANL/Computing Research
 Teleradiology
 Image Feature extraction

Los Alamos High Onate High
 Virtual collocation
 Data browsing
 Visualization
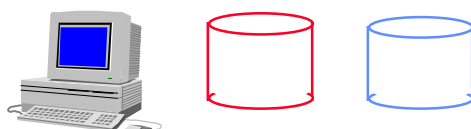
LANL/Statistical Assessment
 Publish IVHS simulations
 Virtual collocation
 Data browsing

LANL/Network Engineering
 Video server

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Approach

Vertical Integration

```
App
 |
Tech1
 |
Tech2
 |
Tech3
```
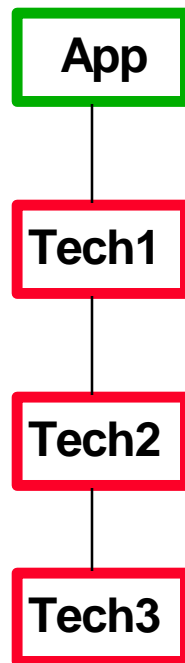
Efficient for given domain
Not always scalable

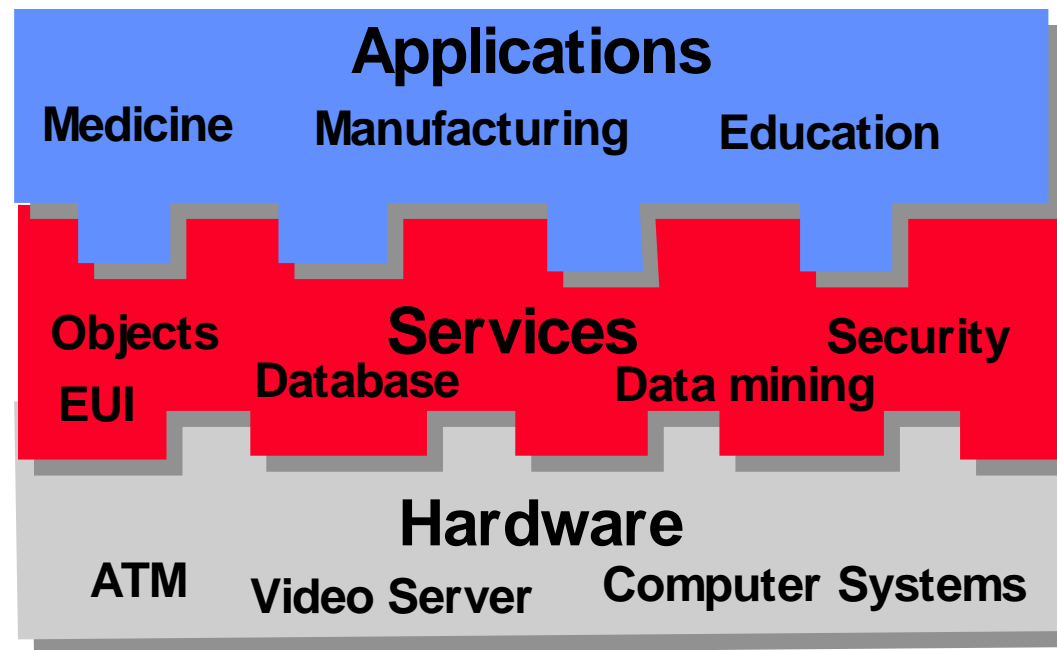## Horizontal Integration

```
App1 — App2 — App3

Tech1 — Tech2 — Tech3 — Tech4
```
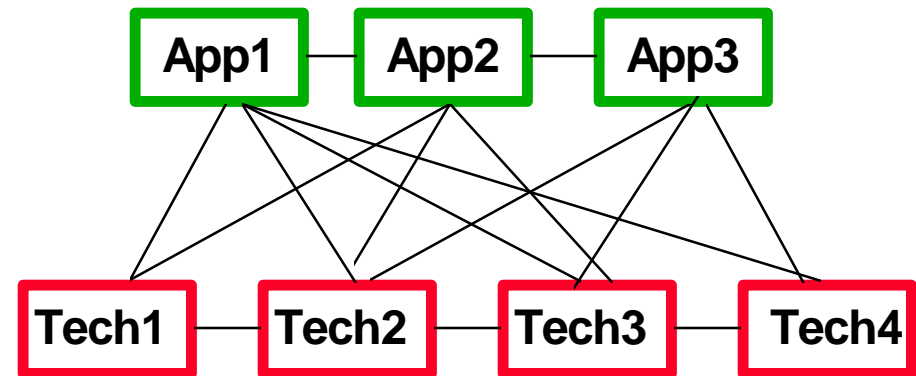
Common tools identifed
Infrastructure clearly delineated
Scalable solutions

Sunrise uses an Integrated, Layered structure

Applications
Medicine   Manufacturing   Education

Objects   **Services**   Security
EUI   Database   Data mining

Hardware
ATM   Video Server   Computer Systems

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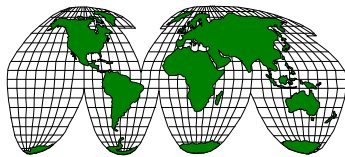NATIONAL LABORATORY
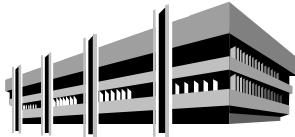*1943 - 1993*

Integrated Applications

- **Telemedicine**

- **Materials modeling and analysis**

- **Transportation information management**

- **K-12 education**

- **Electronic publications**

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1 9 4 3 - 1 9 9 3

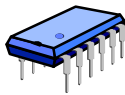# Objects Provide a Scalable Software Architecture

Different Scales

Widely distributed Objects

Network-Distributed Objects

Multi-process, local Objects

Lightweight, single-process Objects
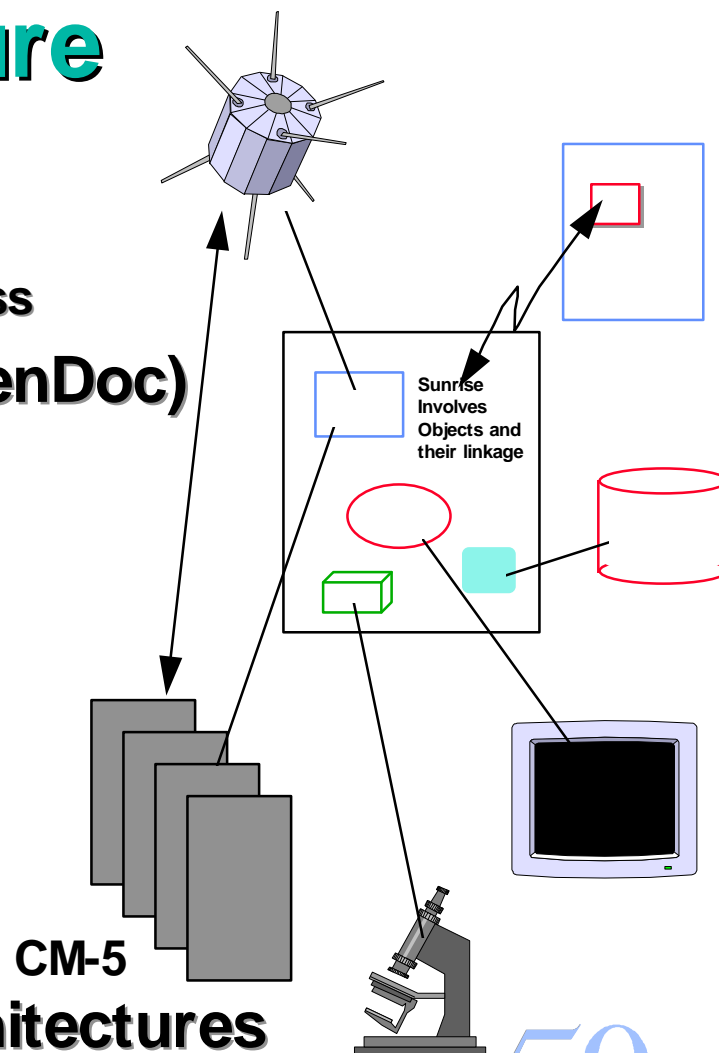
Different Types

OODB Objects

OLTP Objects

C++ Objects

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Reusable, Extensible Infrastructure

- **Distributed Object System**
  - **Dynamic, hierarchical, desktop acess**
- **Document interface (e.g., OpenDoc)**
  - **Nested, remote, objects**
  - **Extensible**
  - **Heterogeneous platform support**
  - **Can link to scientific application**
- **Multimedia support (ATM)**
- **Security for each object**
- **Telecollaboration**
- **Spans multiple hardware architectures**

Sunrise
Involves
Objects and
their linkage

CM-5

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Emphasize Technology Reuse

- **Image Browsing tools**
  - Feature extraction works for materials, medical images, financial data, transportation networks
  - Extension of feature extraction to other domains

- **Standardized base objects**
  - Common elements such as signatures, image, embeddability
  - Portable across systems and storage technologies

- **Navigation tools**
  - Location finding, object name resolution, network display
  - Log books, secure time stamps

- **Digital video might be computer output or instrument output**
  - Data fusion combines different types of data

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The People combine diverse backgrounds and domains of expertise

- **Dick Phillips**
- **Pat Kelly, Mike Cannon, Jon Bradley**
- **Bob Tomlinson, Ron Daniel**
- **John Reynders, Paul Hinker, David Kilman, MaryDell Tholburn**
- **Mike Neuman**
- **Rich Lesar, Niels Jensen**
- **Doug Roberts**
- **Pat Eker, Tim Merrigan**

External Collaborators

- **Gain Momentum (Sybase)**
- **Iona**
- **National Jewish Immunology and Respiratory Center**
- **Fore Systems**
- **Xerox**
- **Los Alamos and Onate High Schools**

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